1064-00-152 **Adel Ardalan*** (ardalan@wisc.edu), **Hesam Dashti**, **James Driver**, **Larry Rolen** and **Amir Assadi**. *Hyperbolic Invariants for Collective Dynamics of Massive Data Sets of Time-Series.* Preliminary report.

Networks offer a general framework for simultaneous study of an ensemble of structures (the nodes) that have pairwise relationships (the edges). In some applications, (e.g. biology/economics), the nodes are represented by a massive ensemble X(t) of n-dimensional real vectors varying with time t (e.g. all gene expressions of a genome, or stock prices in a market), and the edges by very large incidence matrices A(t). We report on preliminary progress in construction of a family of quantitative invariants for exploring global dynamic behavior of X(t) in short term and asymptotically. We demonstrate their use in answering challenging questions in systems biology and social networks, such as if two networks would have time evolutions to closely related networks, or diverge to networks with different probabilistic behavior. Further, we derive numerical estimates for the average rate of convergence to a common network or divergence to different ones. The arguments are based on a synthesis of methods from hyperbolic geometry, probability theory and computational mathematics. Concrete applications to biology and economics are also mentioned. (Received September 06, 2010)